32. Phase Separation in Reacting Soft Matter(II) : Ordering by Long-Range Interaction(poster presentation,Soft Matter as Structured Materials)

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Phase Separation in Reacting Soft Matter (Ⅱ): Ordering by Long-Range Interaction

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[概要]
光反応を利用して二種の高分子ネットワークが絡み合った分子複合体(相互侵入高分子網目：IPNs)の合成を行った。成分高分子にはポリスチレン(PS)とポリメチルメタクリレート(PMMA)を用いた。この二種類のネットワークを同時に形成させることでIPNを作製した。IPNsの形成過程において反応がある程度進行すると、やがて系は相分離し、共連続構造が発現した。さらに、相分離が進行している最中、発現した弾性ひずみに伴うdisorder-order (hexagonal) 転移が観測された。

1. Introduction

Interpenetrating Polymer Networks (IPNs) are polymer composites that comprise of two or more different network polymers entangling with each other. We synthesized full-IPNs of polystyrene (PS) and poly (methyl methacrylate) (PMMA). The PS component was labeled with anthracene used as a photo-crosslinker to generate the PS-network. In addition, PS was also labeled with fluorescein for imaging by confocal laser scanning microscopy (CLSM). PMMA-network was prepared by photo-polymerization of methyl methacrylate. Upon irradiation with UV light, PS- and PMMA- networks were simultaneously generated by the photo dimerization of anthracene chemically attached on PS chains and by photo polymerization of MMA in the originally homogeneous mixture. When the reaction yield reaches a threshold, the mixture is separated into two phases.[1] In this study, we discuss the phase separation kinetics and the morphology observed for these reacting samples.

2. Results and Discussion

It was found from *in situ* observation using CLSM that the bicontinous structure emerges during at the early stage of cross-link and polymerization. As irradiation time increases and the hexagonal phase appears as illustrated in Figs.1 and 2. This hexagonal phase is confirmed by 2D-FFT as shown in Fig.3. It seems that there are two competing factors responsible for the emergence of this hexagonal phase: suppression of the PMMA-rich (black) domains by the cross-linking reactions and the elastic repulsion between these growing domains.[2] The details of this ordering mechanism will be discussed at the poster session.

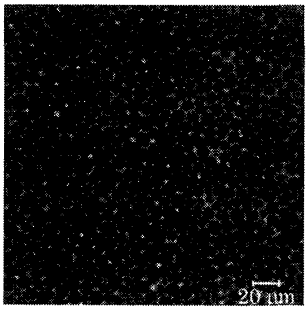

Fig.1. An example for the hexagonal morphology observed under CLSM. The bright and dark phases correspond respectively to the PS- and PMMA- rich phases.

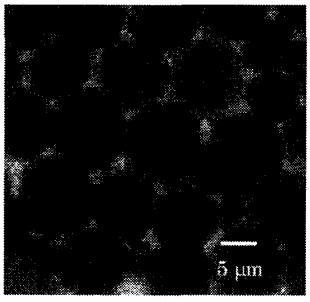

Fig.2. Morphology of the same sample observed with higher magnification.

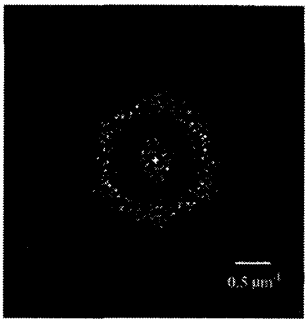

Fig.3. 2D-FFT power spectra correspond to the morphology show in Fig.1

Acknowledgements

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References

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